

AMENDMENTS TO THE CLAIMS

This listing of claims supersedes all prior versions and listings of claims in this application:

LISTING OF CLAIMS:

1. (Currently Amended): An adaptive array antenna receiving apparatus which receives a CDMA transmitted signal by a plurality of antenna elements (~~1-1 to 1-N~~) forming an adaptive array antenna and which includes a ~~predetermined number L~~ plurality of fingers for receiving a multipath signal, ~~where L is an integer greater than one~~, said receiving apparatus comprising:

a ~~predetermined number L~~ plurality of despreading means (~~3-1-1 to 3-L-N~~) forming said ~~predetermined number of~~ fingers, respectively each of said ~~predetermined number of~~ despreading means being connected to said antenna elements and supplied with received signals from said antenna elements for despreading the received signals to produce despread signals;

a ~~predetermined number L~~ plurality of weighting factor multiplying means (~~4-1 to 4-L~~) also forming said fingers, respectively, and supplied with the despread signals from said ~~predetermined number of~~ despreading means, respectively, each of said ~~predetermined number of~~ weighting factor multiplying means ~~being for~~ multiplying the despread signals by weighting factors calculated for said antenna elements to produce a weighted signal for a corresponding one of said fingers;

combining means ~~(6) supplied with the weighted signals from said predetermined number of weighting factor multiplying means~~ for combining the weighted signals, supplied from said weighting factor multiplying means to produce a rake combined signal;

error signal producing means ~~[(8)]~~ supplied with the rake combined signal and a reference signal for calculating a difference between the rake combined signal and the reference signal to produce a common error signal representative of the difference; and

a ~~predetermined number~~ plurality of antenna weight control means ~~(5-1 through 5-L)~~ also forming said fingers, respectively, and supplied with the despread signals from said ~~predetermined number~~ of despreading means included in corresponding ones of said fingers, respectively, and with the common error signal in common and connected to said ~~predetermined number~~ of weighting factor multiplying means included in corresponding ones of said fingers, each of said ~~predetermined number~~ of antenna weight control means being for controlling the weighting factors for each of said ~~predetermined number~~ of weighting factor multiplying means so that a mean square of the common error signal is minimized, wherein each of said antenna weight control means controls the weighting factors for each of said weighting factor multiplying means by using an N-order, where N is greater than or equal to two, correlation matrix as an adaptive update algorithm, wherein there are N antenna elements.

2. (Currently Amended): An adaptive array antenna receiving apparatus as claimed in claim 1, wherein ~~each of said predetermined number of control means~~ uses an RLS (Recursive

Least Square) algorithm is used as an adaptive update algorithm ~~for controlling the weighting factors for each of said predetermined number of weighting factor multiplying means.~~

3. (Cancelled).

4. (Currently Amended): An adaptive array antenna receiving apparatus as claimed in claim ~~[[3]]~~ 1, wherein

said reference signal is a signal equivalent to a known pilot signal and each of the received signals is the known pilot signal; and

further comprising deciding means (11) for making a data decision upon the rake combined signal produced by said rake combining means to produce a decision output signal and switching means (12) for selectively switching the decision output signal produced by said deciding means and the reference signal, said switching means being controlled so that, when the received signal is the pilot signal and when the received signal is a data signal other than the pilot signal, the reference signal and the decision output signal are selected, respectively, to be supplied to said error signal producing means.

5-7. (Cancelled).

8. (Currently Amended): An adaptive array antenna receiving apparatus as claimed in claim 1, wherein each of said ~~predetermined number L~~ plurality of antenna weight control means uses an SMI (Sample Matrix Inversion) algorithm as an adaptive update algorithm for controlling the weighting factors.

9-10. (Cancelled).

11. (Currently Amended): A receiving method for use in an adaptive array antenna receiving apparatus which receives a CDMA transmitted signal by a plurality of antenna elements (~~1-1 to 1-N~~) forming an adaptive array antenna and which includes ~~first through L-th a~~ plurality of fingers for receiving a multipath signal, ~~where L is an integer greater than one~~, said receiving method comprising:

~~first through L-th~~ despreading steps (~~3-1-1 to 3-L-N~~) carried out in said ~~first through said L-th~~ plurality fingers, respectively, each of ~~through said L-th~~ despreading steps being supplied with received signals from said antenna elements, for despreading the received signals to produce despread signals;

~~first through L-th~~ a plurality of weighting factor multiplying steps (~~4-1 to 4-L~~) also forming said fingers, respectively supplied with the despread signals from said ~~first through said L-th~~ despreading steps, respectively, each of said ~~first through said L-th~~ plurality of weighting factor multiplying steps being for multiplying the despread signals by weighting factors

calculated for said antenna elements to produce a weighted signal for corresponding one of said fingers;

a combining step ~~(6)~~ supplied with the weighted signals from said first through said L-th weighting factor multiplying steps for combining the weighted signals supplied from said weighting factor multiplying steps to produce a rake combined signal;

an error signal producing step ~~[(8)]~~ supplied with the rake combined signal and a reference signal for calculating a difference between the rake combined signal and the reference signal to produce a common error signal representative of the difference; and

~~first through L-th~~ antenna weight control steps ~~(5-1 through 5-L)~~ supplied with the despread signals from said ~~first through said L-th~~ despread steps, respectively, and with the common error signal in common, each of said ~~first through said L-th~~ antenna weight control steps being for controlling the weighting factors for each of said ~~first through said L-th~~ weighting factor multiplying steps so that a mean square of the common error signal is minimized, wherein each of said antenna weight control steps has a means for using an N-order, where N is greater than or equal to 2, correlation matrix as an adaptive update algorithm, where N is the number of antenna elements.

12. (Currently Amended): A receiving method as claimed in claim 11, wherein each of said ~~first through said L-th~~ antenna weight control steps uses an RLS (Recursive Least Square)

algorithm as an adaptive update algorithm for controlling the weighting factors for each of said first through said L-th weighting factor multiplying steps.

13. (Cancelled).

14. (Currently Amended): A receiving method as claimed in claim ~~[[13]]~~ 11, wherein,
said reference signal is a signal equivalent to a known pilot signal and each of said
received signal is the known pilot signal; and

further comprising a deciding step (11) for making a data decision upon the rake combined signal produced by said rake combining step to produce a decision output signal and a switching step (12) for selectively switching the decision output signal produced by said deciding step and the reference signal, said switching step being controlled so that, when the received signal is the pilot signal and when the received signal is a data signal other than the pilot signal, the reference signal and the decision output signal are selected, respectively, to be supplied to said error signal producing step.

15-17. (Cancelled).

18. (Currently Amended): A receiving method as claimed in claim ~~[[17]]~~ 11, wherein each of said ~~first through said L-th~~ antenna weight control steps uses an SMI (Sample Matrix Inversion) algorithm as an adaptive update algorithm for controlling the weighting factors.

19-20. (Cancelled).